

NOAA's National Weather Service

Satellite Data Utilization: 2010-2020

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Hyper-Spectral Workshop

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Outline

- ***Initial Capabilities (1980-1989)***
- ***Recent Capability Enhancements (1990-1999)***
- ***Current and Near Future Capabilities (2000-2009)***
- ***Hyper Spectral Data Utilization (2010-2020)***
- ***Future Challenges and Opportunities (2010-2020)***
- ***Summary***

Initial Capabilities

Early Operational Satellite Usage (1980-1989)

- ***Near Real-Time Data Distribution over “Stove-Pipe” Networks***
- ***Stand-Alone Digital Image Processing in Operations (McIDAS, SWIS)***
- ***Limited Use of Satellite Data in Models***
 - ***Sounding Retrievals***
- ***GOES Rapid Scan Basis for Improving Warning Lead-Times***

Recent Capability Enhancements

Integration of Satellite Data in Operations

1990- 1999

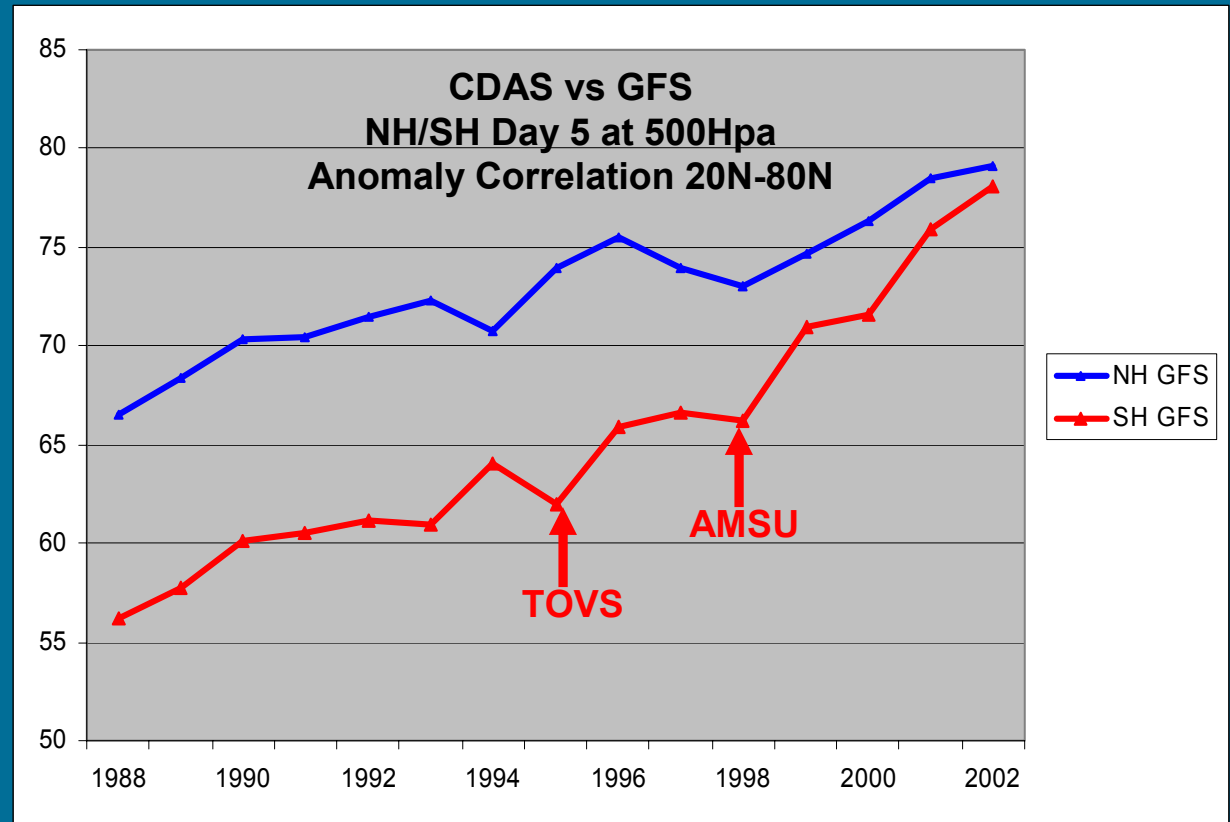
- **Satellite Product Distributed on Multi-Use Networks (SOO / SAC, RAMSDIS , NOAAPORT)**
- **Satellite Data Integrated into Multi-Use Data Display Applications (AWIPS)**
- **Enhanced Use of Satellite Data in Models**
 - *Direct Assimilation of TOVS Radiance in 1995*
 - *Assimilation of AMSU Radiance Data in 1999*
- **Significant Improvement in Southern Hemisphere Model Forecast**

Recent Capability Enhancements

Integration of Satellite Data in Operations

1990- 1999

**Impact of
Direct
Assimilation
of TOVS
(1995) and
AMSU (1999)**



Current and Near Future Capabilities

Exploiting Available Data

2000-2009

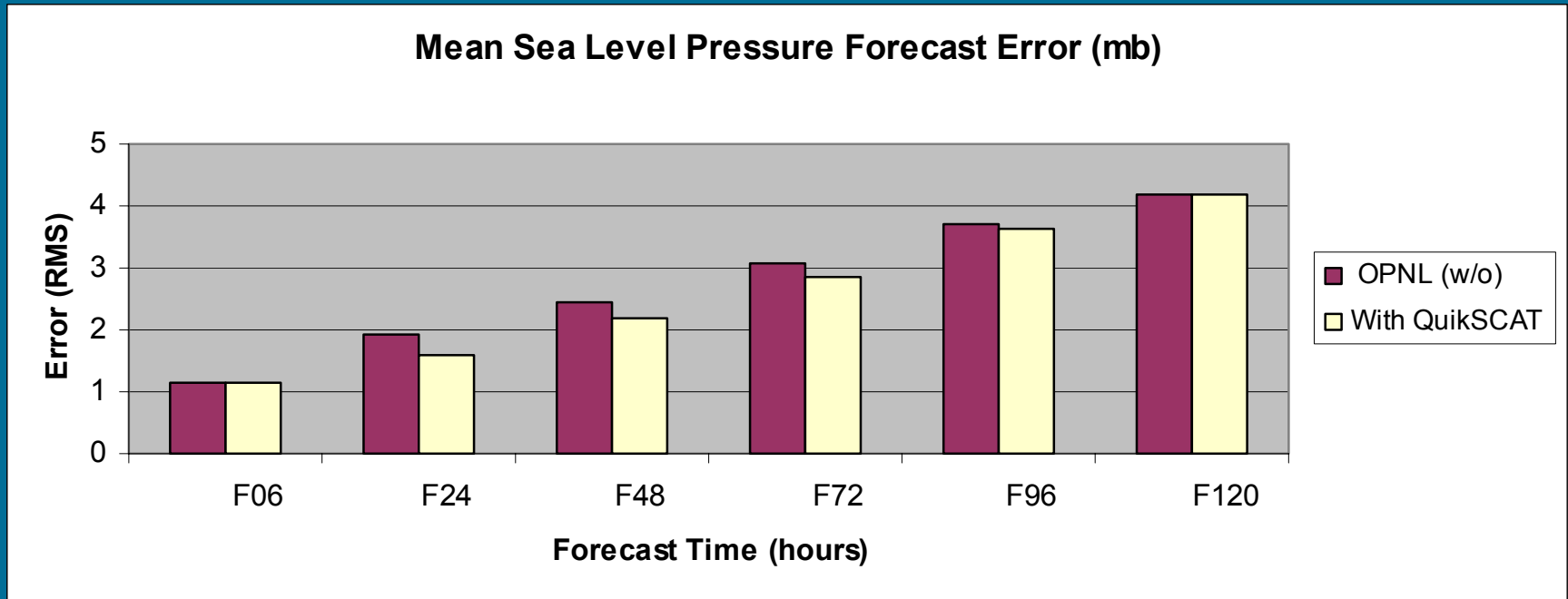
- ***Expanded Use of Communication Networks to Saturation***
 - NOAAPORT, NWS-Net, AWIPS Wide Area Network (WAN)
- ***Enhanced Satellite Data Integration into AWIPS***
 - Derived Products: Integrated PW, Stability (LI), High Density Winds, Soundings, Rain Rate, Sea Surface Temperature (SST)
 - Non-NOAA Products: DMSP SSM/I, QUIKSCAT (OB4)
- ***Enhanced Use of Satellite Data in Models***
 - AMSU Radiance, DMSP SSM/I QUIKSCAT, NPP
 - Rapid Model Downscaling (Eta: 24 to 100 layers, 40 Km to 8 Km)
 - NASA/NOAA Joint Center for Satellite Data Assimilation (JCSDA) Formed
- ***Steady Improvement in Model Forecast***
 - Wind/Wave and Hurricane Track Models Benefit from **QUIKSCAT Winds**
 - AMSU radiances over land through JCSDA community emissivity model

Recent Capability Enhancements

Integration of Satellite Data in Operations

2000- 2009

Forecast Improvement from Assimilation of Quikscat Winds into the NCEP Ocean Analysis



Future Observing Systems

Observing System Trends: 2010-2020

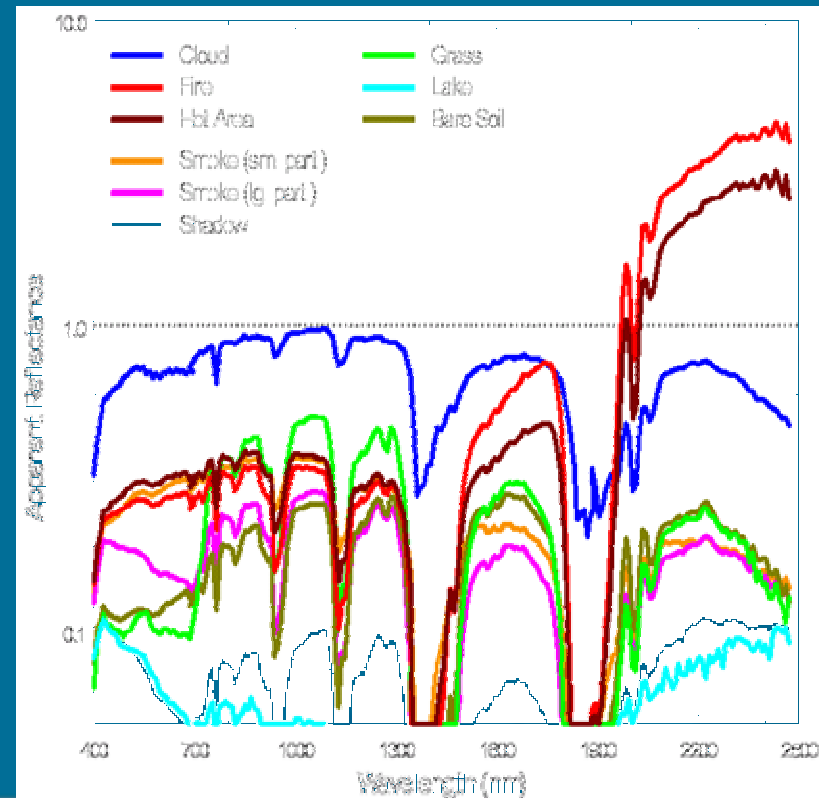
- **Integrated Observing Systems**
- **Increasing Resolution (time, space, and spectral)**
- **Increasing # Key Parameters Observed**
- **Improving Assimilation Strategies**

Future Hyper Spectral Data Utilization

NWS Expectations: 2010-2020

Sensor Performance:

- Improve detection of critical parameters
 - *Atmospheric inversions (fog, caps, etc.)*
- Additional parameters:
 - *Cloud properties, surface properties*
- Increased horizontal/vertical resolution
 - *Moisture gradients*
- Improved accuracy and latency
 - *Improved wind accuracy*
 - *“Rapid scan” GOES HES-ABS (4/hour)*



Future Hyper Spectral Data Utilization

NWS Expectations: 2010-2020

Service Enhancements:

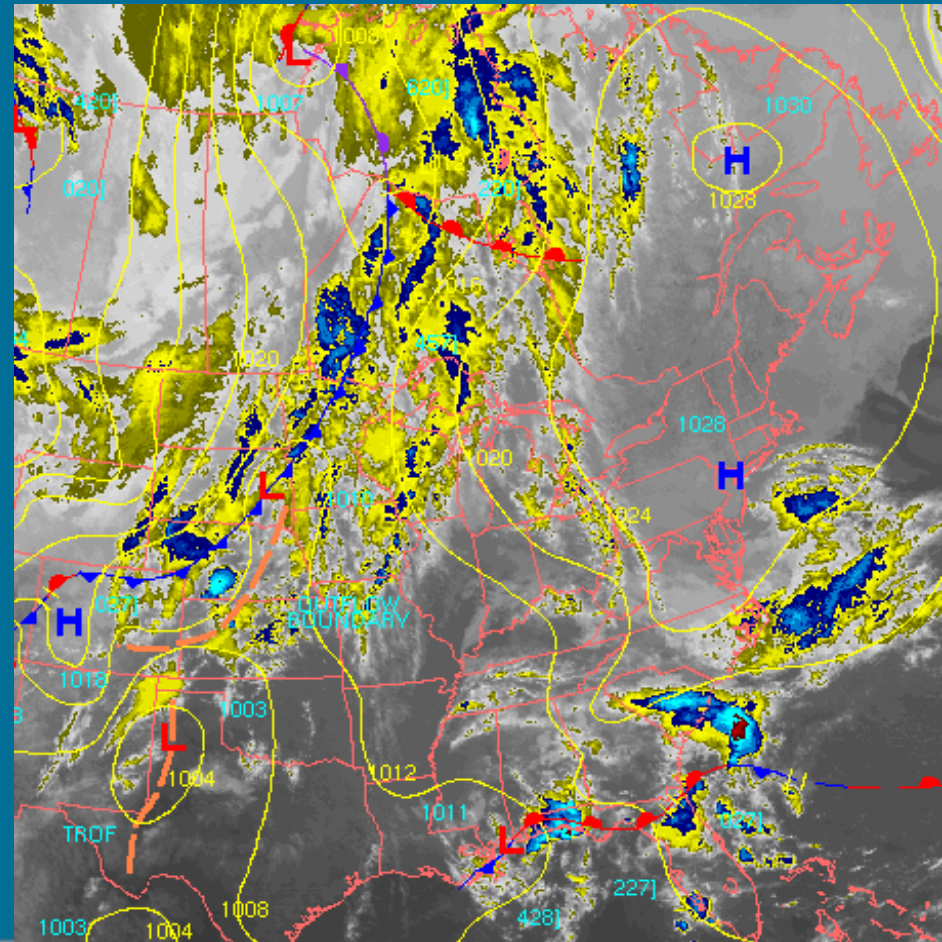
- **Improved support to core missions:**
 - *Protection of Life and Property*
 - *Enhance the National Economy*
- **New services supported:**
 - *Air quality and Homeland Security*
 - Ozone and Aerosols

Future Hyper Spectral Data Utilization

Data Availability Impact: 2010-2020

Contribute to “Analysis of Record”

- *Fills in gaps that in-situ observing systems Verify gridded forecasts*
- *Surface temperature (IR data w/ conventional obs)*
- *Precipitation (w/ radar, gauge)*
- *Sky cover (w/ surface obs)*

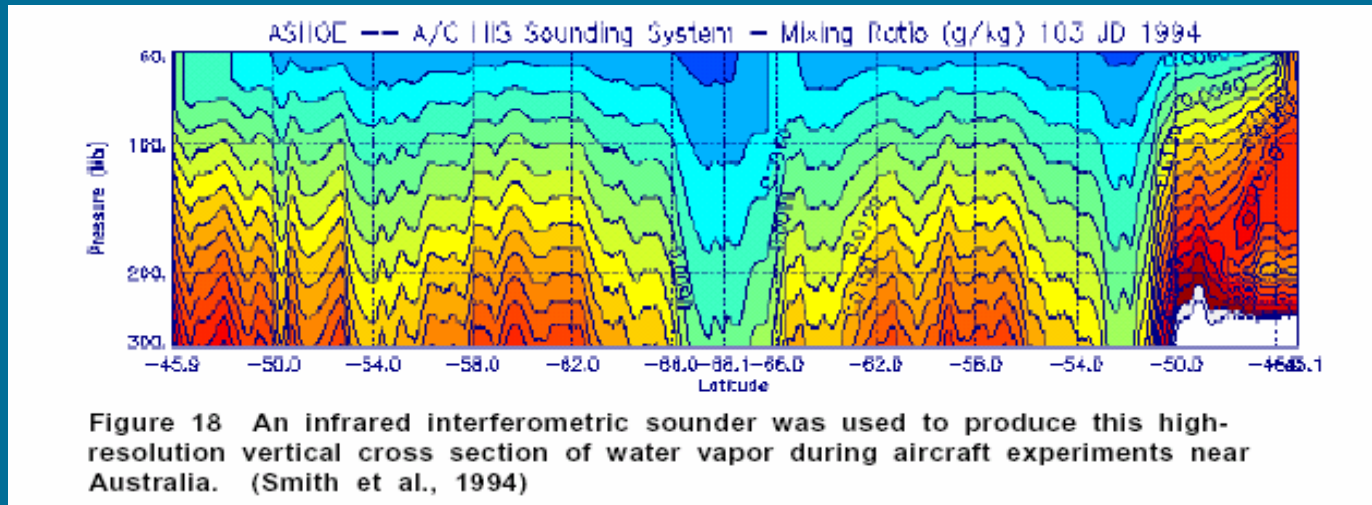


Future Hyper Spectral Data Utilization

Data Availability Impact: 2010-2020

Improved MetWatch

- *Enhanced vertical and horizontal temperature/moisture gradients*
- *Improved diagnosis of pre-convective instability*
- *Detection of inversions (fog, caps, winds)*
- *Convective applications (stability, lightning, etc)*

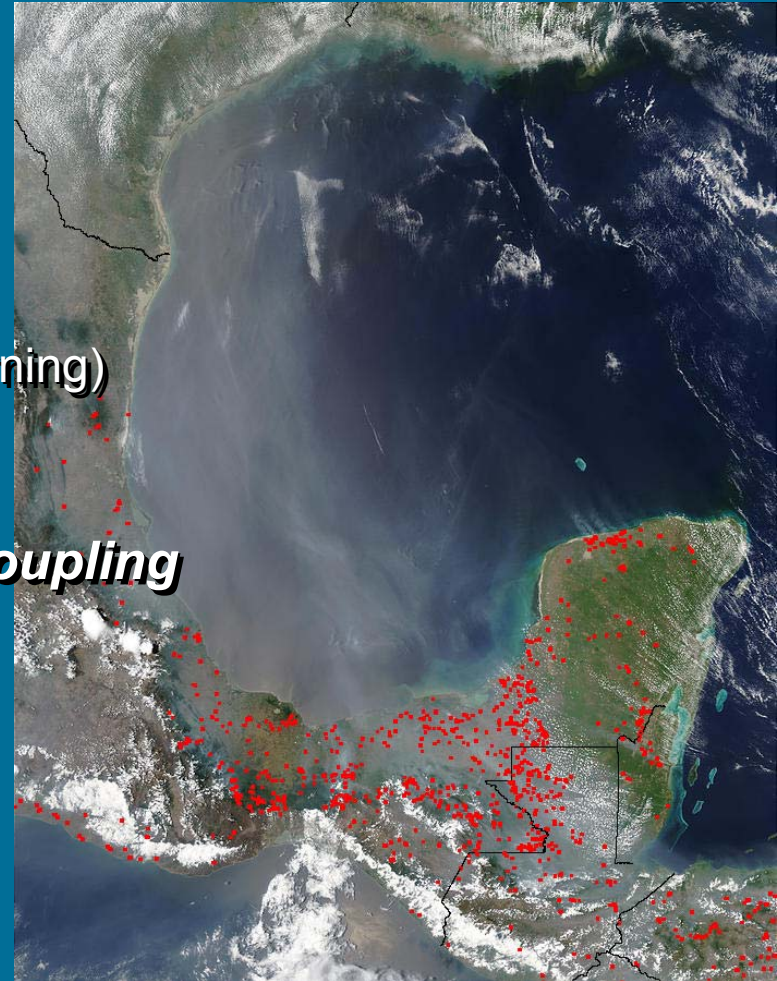


Future Hyper Spectral Data Utilization

Data Availability Impact: 2010-2020

Improved Climate Monitoring

- ***Improved Radiative Forcing***
 - Cloud Properties (amount, top, phase)
 - Aerosol Tracking (smoke, bio-mass burning)
 - Long and Short Wave Radiation
- ***Improved Land/Ocean/Atmosphere Coupling***
 - Soil Moisture and Temperature
 - Vegetative Type and Greenness
 - Cryosphere Monitoring (Snow/Ice)
 - Sea Surface Temperatures



Future Hyper Spectral Data Utilization

Data Availability Impact: 2010-2020

Better Hydrology Monitoring

- *Improved Precipitation Rate and Amount*
 - Improved Resolution - CMIS @ 15 Km; HES-ABS @ 4Km
- *Improved Hydrologic Forcing*
 - Better Soil Moisture and Temperature Res (4Km)
 - Improved Vertical Moisture (2Km) and Gradients
 - Improved Sea Surface Temperature (4Km)

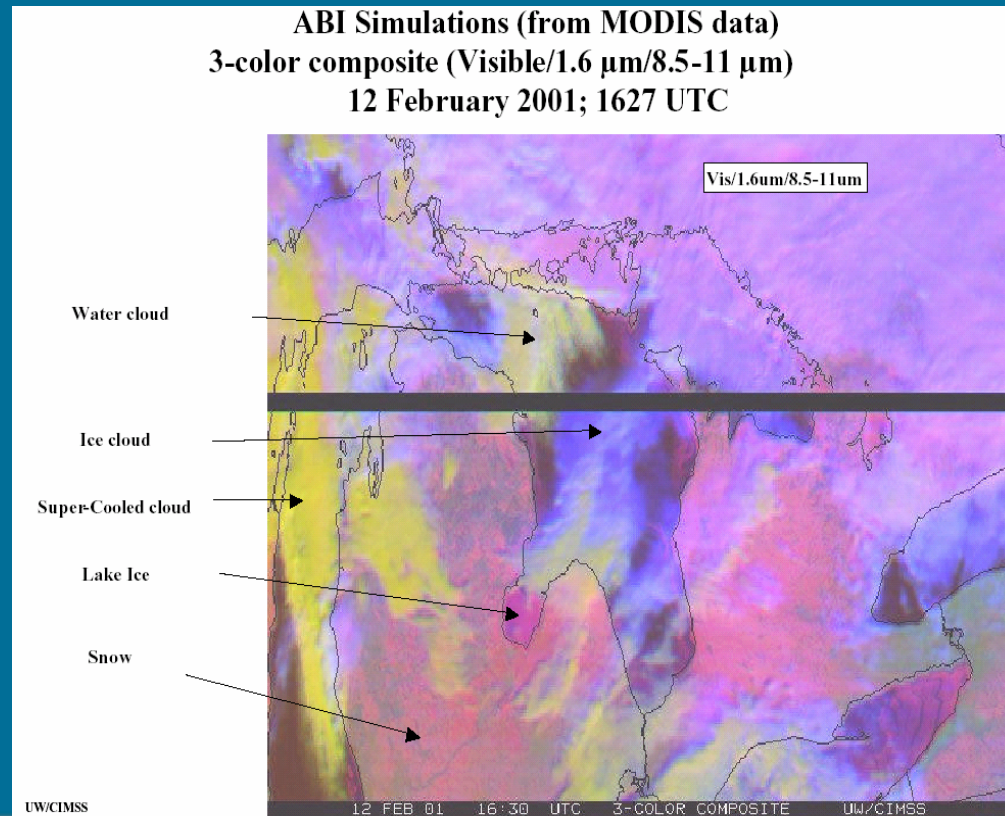


Future Hyper Spectral Data Utilization

Data Availability Impact: 2010-2020

Improved NWP Forecasts

- ***1/3 reduction in cloud contamination***
 - More satellite data used in NWP
- ***Better cloud phase discrimination***
 - Critical in aviation icing forecasts
 - Important for initializing clouds and precipitation
- ***Improved Vertical Moisture using GPS radio occultation (RA) data***
 - GPS compliments CRIS, CMIS, ATMS vertical soundings



Future Hyper Spectral Data Utilization

Data Availability Impact: 2010-2020

Improved NWP Forecasts

- *Improved land data assimilation*
 - High Resolution vegetation types, soil temp and RH
 - Improved boundary layer forecasts
- *Improved cloud drift winds*
 - More layers sensed
 - Boundary layer to upper troposphere
 - Higher spatial resolution
 - Better height assignment

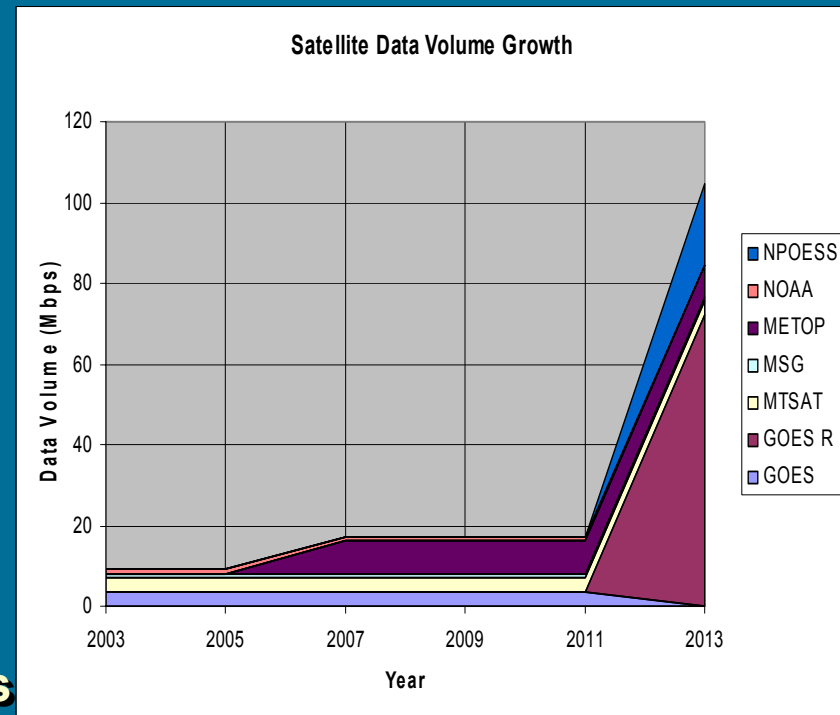
Future Challenges and Opportunities

Significant Change to Satellite Systems

2010-2020

Developing an End-to-End Solution

- ***Seamless Research to Operations***
 - Research grade code integrated into ops CM
 - JCSDA and Ops develop code together
- ***NOAA Enterprise Architecture***
 - *Processing throughput*
 - *Reliability*
 - *Proto-Typing*
 - *Cost effective Science Infusion*
- ***NOAA Observing System Architecture***
 - *Integrated Observing System*
- ***Efficient Information Extraction Techniques***
 - *>95% of all data used in operations*
- ***Effective Training Program***



Summary

NWS Hyper-Spectral Data Utilization

**Work closely with NASA and NESDIS to
Develop End-to-End Solutions Supporting the
NOAA Mission**

Goals:

- **Implement new satellite data with 1-2 years of launch**
- **Size end-to-end system processing and computing resources to accommodate 5X data volume increase**